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In Re Patent Application Of: Babchin et al.

File No: 51-15 US CIP/PCT

Application No: 09/929,092

Group Art Unit: ~~1741~~ 1742

Filed: August 15, 2001

Examiner: ~~Unknown~~ Leader

Title: Dielectric Breakdown Chemical Reactor for Liquids

February 20, 2003

The Commissioner of Patents and Trademarks  
Washington, D.C., 20231, U.S.A.

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Submission of Certified Copy

Sir:

In order to substantiate Applicant's claim to priority in the present application, we enclose herewith a certified copy of **Canadian Application No. 2,262,033** filed **February 16, 1999**.

We look forward to receiving the Priority Acknowledgement in due course.

Respectfully submitted,

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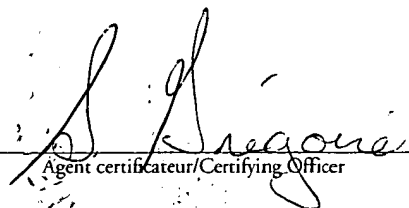
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attached hereto and identified below are  
true copies of the documents on file in  
the Patent Office.

Specification and Drawings, as originally filed, with Application for Patent Serial No:  
**2,262,033**, on February 16, 1999, by **ALBERTA RESEARCH COUNCIL**, assignee of  
Alexander Joseph Babchin, Jian-Yang Yuan, Ezra Eddy Isaacs, Haibo Huang and Ross  
Sam Chow, for "Chemical Reactor Enhanced by High Frequency Electric Field".

  
Agent certificateur/Certifying Officer  
February 6, 2003

Date

Canada

(CIPO 68)  
04-09-02

OPIC  CIPO

**Abstract of the Disclosure**

This invention relates to the enhancement of chemical reactions by applying a high frequency electric field to a material. The frequency and amplitude of the electric field are selected in accordance with the properties of the reacting components in the bulk of chemical reactor. In  
5 general, the high frequency range is determined by the dielectric properties of reactant(s), that is, at any given temperature, when, for example, the specific conductivity starts to grow from its low frequency value. Typically, frequencies in the range of one kilohertz to 30 megahertz or greater are suitable for the enhancement of the reactions. An electric field of any shape having  
10 Fourier components that when applied to any chemical reaction process exhibits growth in the real part of conductivity relative to low frequency value is the subject of this patent.

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Patent

## **Chemical Reactor Enhanced by High Frequency Electric Field**

### **5 Field of the Invention**

This invention relates to the application of high frequency electric fields for the enhancement of reactions of chemical compounds.

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### **Background of the Invention**

In contemplation and discussion of a problem that has plagued the electric power industry for decades; the dielectric breakdown of liquids used as insulators; the inventors of the instant  
15 invention have discovered that high frequency electric fields assist chemical reactions of many chemical compounds. In the power industry, low frequency electric fields, in the range of 60 Hz, over time, assist in the unwanted breakdown of liquid insulators.

United States Patent 5,296,106 and United States Patent 5,397,447 issued March 14, 1995 in the  
20 name of Rolison et al. issued March 22, 1994 suggest using a constant DC field to assist in chemical reactions. In United States Patent 5,137,607 issued August 11, 1992 to Anderson et al. variable DC voltage is suggested to vary voltage and polarity over time, to change the Fermi level of the membrane relative to the electrode to create a favorite condition for certain reaction or reaction direction to occur. However it is understood that very low frequency varying voltage  
25 of less than one Hz is required for this to occur.

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### Summary of the Invention

In accordance with this invention a method is provided for enhancing the reaction of chemical compounds comprising the step of applying an electric field having a frequency which is typically but not limited to the frequency range of 1 kHz to 30 MHz.

In accordance with the invention there is further provided a method for enhancing the reaction of chemical compounds comprising the step of applying an electric field at any voltage at selected frequencies determined by the dielectric properties of the reactants.

### Detailed Description

This invention is particularly useful to selectively increase the reactivity of chemical compounds including crude oils and convert them to higher valued products. More specifically, it is found that by tuning the electric field to a particular frequency range for favorable conditions for reactions occur (such as at significantly lower severity conditions) that would otherwise not be achieved without tuning the field. The selection of the appropriate field is based on but not limited to frequency dependent specific conductivity of the reactive material. By way of example, Figure 1 is a plot of the measured specific conductivity of 50% weight Athabasca Bitumen in tetralin as a function of frequency under an applied electric field of about 10 volt/cm in amplitude. This experimental result obtained at the Alberta Research Council laboratory demonstrates that at frequencies above 1 MHz the specific conductivity of the solution increases dramatically such that lower voltage will be required to achieve reactivity.

This invention relates to a chemical reactor that uses high frequency electric fields of any shape at the dielectric breakdown or pre-breakdown conditions in order to initiate and/or enhance chemical reaction. The selected high frequency or high frequency range is determined by the

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dielectric properties of reactant(s), that is at any given temperature, when for example the specific conductivity increases from its low frequency value.

5 By way of example, two coaxial cylinders with annulus filled with chemical reactants and electric field applied using the cylindrical walls, as electrodes constitute such type of chemical reactor. Of course other types of reactors wherein suitable high electric fields can be applied are also the subject of this invention. At yet higher frequencies wave-guides or special antennas can be used for introduction of electric field into the reactant mass. The product from such a reactor can in liquid, gaseous, or solid state or any mixture thereof.

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Ideally, the reactants are under AC electric field everywhere within the cell such that the AC electric field penetrates the space between the electrodes and affects all molecules between the electrodes. Therefore, chemical reactions enhanced by the AC electric field occur simultaneously in the bulk of the chemical reactor. By tuning the frequency of the AC electric field optimum control and enhancement can be achieved.

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### Claims

What we claims is:

- 5 1. A method of enhancing a chemical reaction comprising the steps of:
- a) providing a chemical reactor
  - b) providing chemical compounds to the chemical reactor;
  - c) applying an electric field having an alternating current with a frequency or a Fourier frequency
- 10 chemical compounds within the reactor.

## 50 wt% Athabasca Bitumen in Tetralin

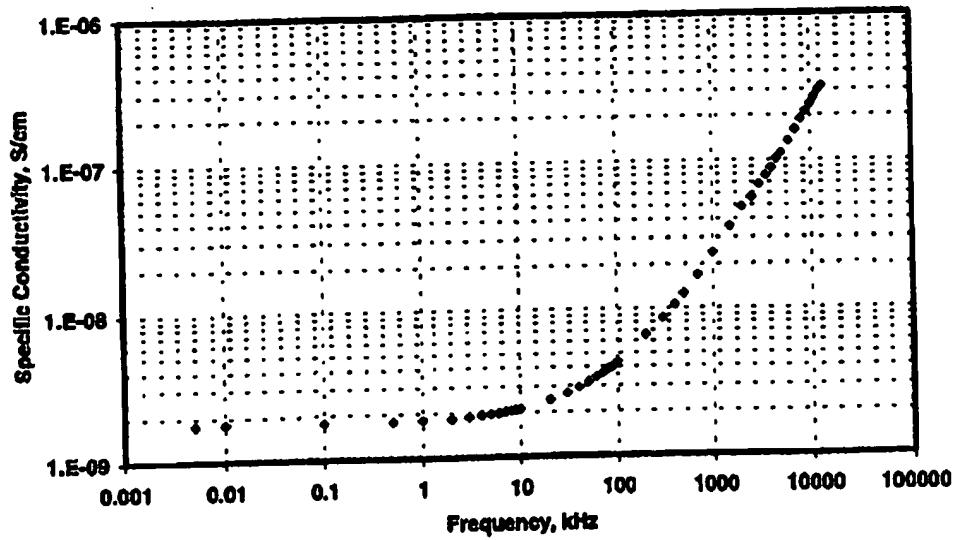


Figure 1: Specific conductivity of 50 wt. Athabasca Bitumen in tetralin.



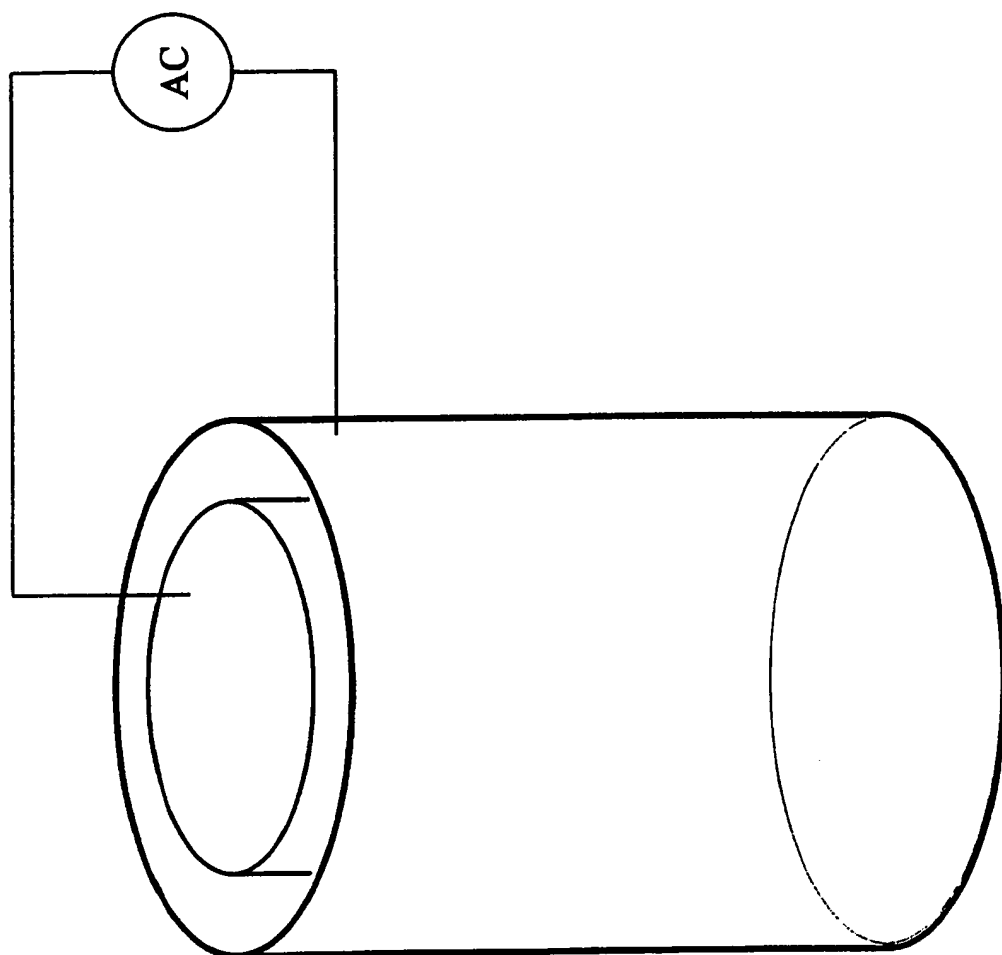


Figure 2